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# Mule Deer Diets on a Chained and Seeded Central Utah Pinyon- Juniper Range

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## THE AUTHORS

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## RESEARCH SUMMARY

Diets of mule deer (*Odocoileus hemionus hemionus*) were studied on a central Utah chained and seeded pinyon (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*) site. Pellet groups were collected from swept plots at 4- to 12-week intervals between November 1985 and September 1986 and analyzed with the microhistological technique. A total of 24 forage items were identified, of which 13 occurred in greater than trace quantities (>1 percent relative composition). Woody species made up the bulk of all samples, 70 to 98 percent. Forb content ranged from 1 to 19 percent relative composition in all samples. Grasses made up 1 to 10 percent of all samples. Several seeded species—big sagebrush (*Artemisia tridentata*), alfalfa (*Medicago sativa*), and wheatgrasses (*Agropyron* spp.)—were seasonally important in deer diets.



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## INTRODUCTION

Pinyon (*Pinus* spp.) and juniper (*Juniperus* spp.) habitats are a large proportion of winter-spring mule deer ranges in the Great Basin of the Western United States. Forage values have declined on much of this area as a result of overgrazing, fire suppression, and dominance by overstory species (Arnold and others 1964; Tausch and others 1981).

In the last 40 years, large areas of pinyon-juniper have been treated to increase forage production for deer or domestic livestock. At least 138,000 ha have been treated in Utah alone (J. Fairchild, personal communication). Treatment typically consists of removal of the tree canopy by mechanical means (chaining, cabling, or dozing), fire, or herbicides. Seeding is often necessary where desirable forage species are absent or too sparse to respond to treatment. Diverse mixtures are superior to monocultures in providing forage for mule deer (Plummer and others 1968). Such mixtures usually contain a variety of native and introduced grasses, forbs, and shrubs.

Despite the number of treatment projects, studies of mule deer food habits in the pinyon-juniper type have largely been restricted to unmodified habitats (Boeker and others 1972; Hansen and Dearden 1975; Ritchens 1967). Published information from modified pinyon-juniper habitats is limited. McCulloch (1969) collected food habit data from a seeded burn in northern Arizona. Terrel and Spillet (1975) presented results from a chained and seeded site in central Utah.

Results of these studies showed considerable variation with season, location, year, and sampling technique. In the presence of such variability, site-specific information is important for management purposes.

This study was undertaken to characterize forage used by mule deer on a chained and seeded central Utah winter-spring range. Fecal samples were collected over 11 months and analyzed with microhistological procedures.

## STUDY AREA

We conducted this study at the Manti Face pinyon-juniper chaining in Sanpete County, central Utah. The treated area encompasses 242 ha at elevations of 1,820 to 1,983 m. Soils are limestone-derived Fontreen Series cobbly loams (USDA SCS 1981). Long-term average annual precipitation is 33 cm.

Prior to treatment, the site was dominated by a closed stand of mature pinyon-juniper with depleted understory vegetation. In November 1961, the site was double-chained and aerial seeded. Between chainings, a seed mixture of native and introduced grasses, forbs, and shrubs was applied by fixed-wing aircraft (table 1).

Because the site is managed primarily for wild ungulates, grazing by domestic livestock has been limited. It was rested for 12 years to enhance establishment of seeded species and recovery of native vegetation. Since then, the site has received five seasons of cattle use and three seasons of sheep use in late spring (May and June) at stocking rates of 1 to 5 ha per animal unit month (AUM).

Posttreatment vegetation in 1986 was dominated by perennial grasses, including fairway (crested) wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*A. intermedium*), western wheatgrass (*A. smithii*), bluebunch wheatgrass (*A. spicatum*), pubescent wheatgrass (*A. trichophorum*), smooth brome (*Bromus inermis*), Russian wildrye (*Psathyrostachys juncus*), Indian ricegrass (*Oryzopsis hymenoides*), and bulbous bluegrass (*Poa bulbosa*). Alfalfa (*Medicago sativa*) was the most abundant forb. The most abundant shrub species were big sagebrush (*Artemisia tridentata*), black sagebrush (*A. nova*), rubber rabbitbrush (*Chrysothamnus nauseosus*), low rabbitbrush (*C. viscidiflorus*), and antelope bitterbrush (*Purshia tridentata*). Reinvasion by

Table 1—Seed mixture and bulk rate applied on Manti Face pinyon-juniper study site, Utah

Species	Rate
	Kg/ha
Fairway (crested) wheatgrass ( <i>Agropyron cristatum</i> )	3.5
Intermediate wheatgrass ( <i>A. intermedium</i> )	1.8
Pubescent wheatgrass ( <i>A. trichophorum</i> )	1.8
Smooth brome ( <i>Bromus inermis</i> )	0.9
Russian wildrye ( <i>Psathyrostachys juncus</i> )	0.9
Alfalfa ( <i>Medicago sativa</i> )	0.9
Yellow sweetclover ( <i>Melilotus officinalis</i> )	0.4
Big sagebrush ( <i>Artemisia tridentata</i> )	0.4
Rubber rabbitbrush ( <i>Chrysothamnus nauseosus</i> )	0.4
Total	11.0

pinyon and juniper has been minimal. Tree density was approximately 60 stems per ha, the majority of which were junipers in the sapling age class (0.5 to 6.0 cm basal diameter). The site is typical of many foothill pinyon-juniper treatment projects in central Utah.

## DATA COLLECTION AND ANALYSIS

Ten 3-m circular plots were randomly located on the site in 1985. Plots were swept clean of all mule deer fecal materials. The plots were sampled six times between November 1985 and September 1986, at 4- to 12-week intervals. All pellet groups were removed at each sampling.

We analyzed samples following the microhistological procedures outlined by Sparks and Malechek (1968). Pellet groups were milled and thoroughly homogenized. Ten slides were prepared from each sample. We read 200 microscope fields per sample, 20 from each slide. Holechek and Vavra (1981) recommended a sample size of nine slides of 20 fields each to estimate all major diet items (>20 percent relative composition) within 10 percent of the mean at a 95 percent confidence level. All plant fragments within a field were identified and counted. Fecal composition was expressed as mean relative fragment density for each identified forage item. Composite reference samples of the most abundant grass, forb, and browse species (collected from the study area) were similarly prepared to aid in plant identification.

## RESULTS AND DISCUSSION

We collected 59 pellet groups during the sampling period. Sample size per collection ranged from five groups (November 1985) to 16 groups (April 1986). Pellet groups

were deposited through the month of June and again in September, indicating that deer use of this site extends beyond early spring.

We identified 24 forage items: six grasses, six forbs, and 12 shrubs and trees. Some items were identified only to genus, as multiple species present on the site were indistinguishable by microhistological techniques. Of these 24 items, 13 occurred in greater than trace (1 percent) amounts (table 2). However, in all samples, the bulk comprised three to four forage taxa. Boeker and others (1972) observed similar feeding patterns on an untreated pinyon-juniper site in New Mexico. Winter diet composition and relative proportions were similar to results from a nearby pinyon-juniper site reported by Terrel and Spillet (1975).

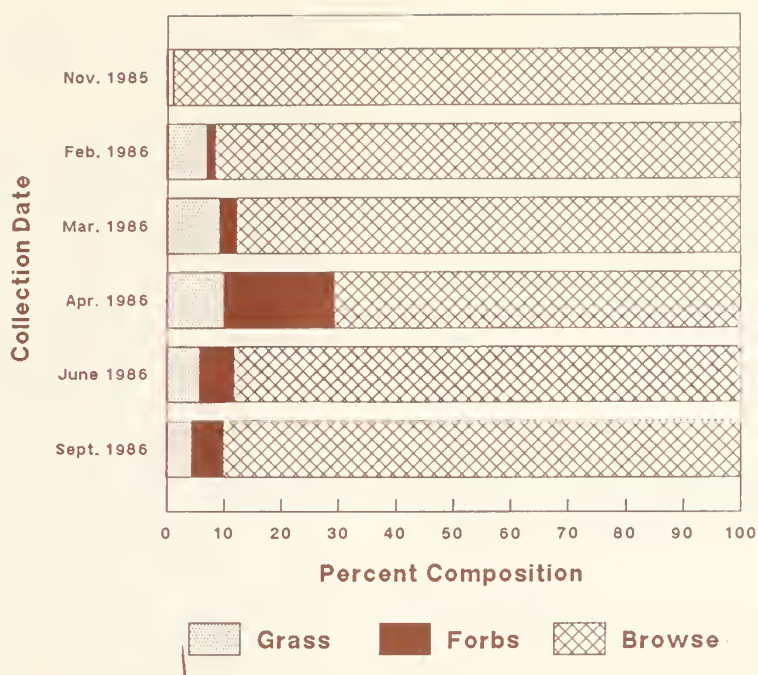
Woody plants were the largest component in all samples, representing 70 to 98 percent of the total composition (fig. 1). The relative composition of browse changed little over the sampling period. Browse content was lowest in the April samples and highest in November. These results were similar to those reported by Boeker and others (1972).

Twelve browse plants were present in greater than trace (1 percent) amounts (table 2). Of these, Utah juniper (*Juniperus osteosperma*) and big sagebrush occurred in the greatest quantity. The proportion of juniper was higher than reported in previous studies (Terrel and Spillet 1975). Juniper is generally considered an emergency food of low preferences and digestibility (Ritchens 1967; Smith and Hubbard 1954). Increased juniper consumption has been associated with persistent low temperatures and snow conditions limiting access to other forages (Hansen and Dearden 1975; Leach 1957). Weather data were not collected in this study, so the

**Table 2**—Mean relative composition of forage plants occurring in greater than trace amounts (1 percent) in mule deer fecal samples collected November 1985 to September 1986 on Manti Face pinyon-juniper treatment study site, Utah, as determined by microhistological analysis

Species	Date of collection					
	Nov. 1985	Feb. 1986	Mar. 1986	Apr. 1986	June 1986	Sept. 1986
<b>Grasses</b>						
<i>Agropyron</i> spp.	—	3.6	2.9	3.6	3.6	3.7
<i>Bromus</i> spp.	—	—	2.2	—	—	—
<i>Poa</i> spp.	—	1.7	4.0	5.6	2.0	—
<b>Forbs</b>						
<i>Medicago sativa</i>	—	1.3	2.6	18.8	5.5	5.2
<b>Browse</b>						
<i>Artemisia tridentata</i>	2.0	15.7	24.7	48.4	15.3	5.0
<i>Atriplex canescens</i>	6.2	—	—	—	—	—
<i>Berberis repens</i>	17.7	3.6	—	—	—	3.0
<i>Cercocarpus</i> spp.	17.7	3.6	—	—	30.2	1.2
<i>Ephedra</i> spp.	—	4.7	—	—	—	1.1
<i>Juniperus osteosperma</i>	63.4	58.3	59.2	21.2	32.5	71.7
<i>Pinus edulis</i>	—	2.4	—	—	—	1.9
<i>Purshia tridentata</i>	—	2.1	—	—	—	—
<i>Quercus gambelii</i>	5.8	—	—	—	9.1	6.5





**Figure 1**—Relative composition of deer fecal samples collected November 1985 through September 1986 at Manti Face pinyon-juniper chaining, Utah, as determined by microhistological analysis.

impact of these factors cannot be assessed. However, persistent deep snow cover was generally lacking during the winter of 1985 to 1986. Presumably, deer had access to other forages during most of the sampling period. The high proportion of juniper could reflect bias in the fecal analysis procedure. Several investigators have reported overestimation of woody browse species due to differential digestibility of plant fragments (Anthony and Smith 1974; Hansen and others 1973).

Forbs were present in all samples, representing 1 to 19 percent of the total summer samples. This pattern has also been reported in deer diets on other pinyon-juniper sites (Anderson and others 1965; Boeker and others 1972).

The forb component was almost entirely alfalfa, while other species were present only in trace amounts (< 1 percent). Actual alfalfa content was possibly much greater than indicated by results of the fecal analysis because of its high digestibility. Alexander (1980) reported that highly digestible forbs taken by tame deer were not detected in fecal samples. Other studies have indicated that microhistological procedures can underestimate forb content (Anthony and Smith 1974; Free and others 1970; Gill and others 1983).

Mule deer consume alfalfa from agricultural plantings, according to Kufeld and others (1973), Leach (1957), and Martinka (1968). However, use of alfalfa on seeded pinyon-juniper ranges has not been previously documented. Results of this study indicate that alfalfa is an important forage in deer diets, particularly in early spring.

Grasses were present in all samples, with relative composition of 1 to 10 percent (fig. 1). Grass content was highest in the March and April samples. Three genera were

present in greater than trace amounts (table 2). Of these, wheatgrasses and bluegrasses were most abundant. The five wheatgrass species present on the site could not be distinguished from one another with microhistological procedures; therefore their relative importance to mule deer could not be assessed.

The observed proportion of grasses in deer diets was higher than reported in studies from untreated pinyon-juniper habitats (Anderson and others 1965; Boeker and others 1972), though lower than amounts reported on other treated ranges (McCullock 1969; Terrel and Spillet 1975). The higher relative proportion of grass in the diet (in comparison to studies in untreated pinyon-juniper habitats) could reflect greater grass availability. Terrel and Spillet (1975) reported significantly higher consumption of grasses on a chained and seeded site where grasses were more abundant, than on an immediately adjacent untreated area.

## CONCLUSIONS

Of the species seeded on this site, big sagebrush, alfalfa, and wheatgrasses occurred most frequently in deer fecal samples. Because of the importance of big sagebrush, future seedings in the pinyon-juniper type should include sagebrush accessions preferred by mule deer, such as those described by Welch and others (1981, 1983). Given the palatability of alfalfa to domestic livestock, spring grazing on these sites should be limited or delayed when production of deer forage is a management priority.

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Study of the seasonal use by mule deer of some native and introduced species on a pinyon-juniper restoration project showed that woody species made up the bulk of pellet samples, followed by forbs and grasses. Land managers are advised on seeding and grazing practices for enhancing big game habitats.

**KEYWORDS:** *Odocoileus hemionus hemionus*, food habits, *Pinus edulis*, *Juniperus osteosperma*, *Medicago sativa*, *Artemisia tridentata*, *Agropyron* spp., microhistological studies, Great Basin, Western United States

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